



Surdex Team

2004 NAIP Post Season Summary

17 November, 2004

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Outline

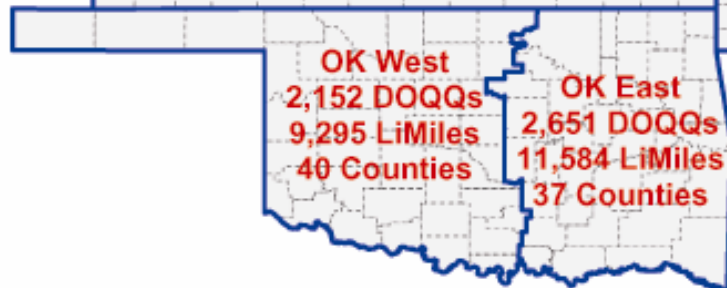
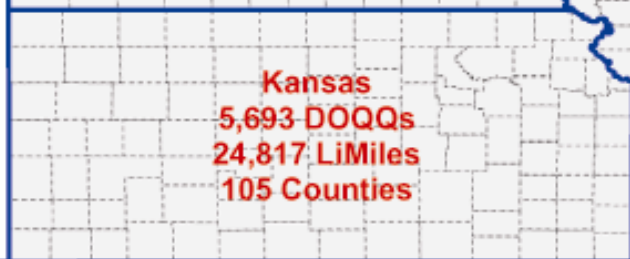
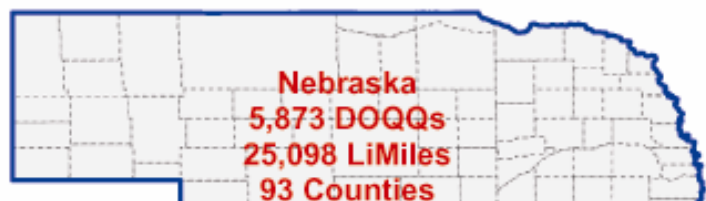


- 2004 project areas
- Technical approach
- Contract performance
 - Completion rates
 - Season extensions and reasons
 - Processing capacity
 - Subcontractor management
- New innovations being tested or implemented
- Lessons learned (successes and failures)
- After-contract sales and anticipated cost savings
- Recommendations for NAIP05+

Team Project Areas



Project Total
24,755 DOQQs
107,015 Line Miles
459 Counties
339,786 Square Miles





Technical Approach



- ABGPS collected for all exposures
 - Deployed base stations
 - CORS was used as backup only
 - Baselines up to 250+ miles – achieved < 1 meter accuracy
- Photography scanned at 1-meter resolution
 - All project areas for 2004 NAIP were 2-meter resolution
 - Only processed to 2-meter during initial production
- Large blocks of photography AT'd using ABGPS:
 - Not constrained to county/CCM boundaries (only project area boundaries)
 - Block sizes of ~300 – 1,500 frames
 - Adjoining AT blocks shared strips and/or frames for consistency
- Orthorectification based on USGS NED surface
- Radiometric balancing accomplished over large areas
 - Not constrained by AT block or county/CCM boundaries
 - Adjoining radiometric blocks shared common orthos to achieve consistency
- Heavy utilization of databases and automation



Overall Contract Performance



- 100% of flying accomplished:
 - Relatively poor weather in MidWest (very good weather in 2003)
 - Extensive deployment of aircrews
 - Some regional home-base operations
 - Short extensions in 4 project areas (all but one in less than 1 week)
- CCM production accelerated in 2004:
 - Last shipment on 9/28/04
 - Achieved very leveled deliveries – more deliveries:
 - ❖ 8.4 CCMs / delivery in 2004 (54 deliveries, 459 counties)
 - ❖ 21.2 CCMs / delivery in 2003 (14 deliveries, 297 counties)
 - Included accuracy validation of CCMs (not contractually required for 2-meter project areas) to support re-sale activities at 1-meter resolution
- Re-sale 1-meter processing nearly complete
 - All project areas
 - Orthorectification complete – only re-balancing left

Photography



- Dates in brackets are contract dates for project areas
- Red highlights window extensions with actual days required to complete in parenthesis

Project	First Day of Photography	Last Day of Photography	Days of Photo	Season (Days)	% Days Flown	Extension Reasons
OK West	06/01 [06/01]	07/05 (+6) [06/30]	18	35	51.4%	Primarily weather, some related to inexperienced flyer
OK East	07/05 [07/01]	08/18 [09/01]	22	45	48.9%	
MO	06/11 [06/10]	08/31 (+16) [8/15]	27	82	32.9%	Film scratches (in lab) Excessive rejections (crab)
KS	06/22 [06/20]	08/02 [08/04]	24	42	57.1%	
NE	07/02 [07/01]	08/21 (+6) [08/15]	21	51	41.2%	Weather and film scratches (lab)
WI	06/20 [06/20]	08/06 [08/30]	20	48	41.7%	
IN	07/01 [07/01]	08/16 (+1) [08/15]	10	47	21.3%	Weather
OVERALL	06/01	08/31	69	92	75.8%	

Photography Efficiency



- Efficiency = (accepted line miles) / (flown line miles)
- Accepted line miles = flown line miles – re-flight line miles

Project	Line Miles	# Aircraft	Efficiency
OK West	11,336	3	0.96
OK East	9,181	4	0.90
Missouri	21,696	6	0.78*
Kansas	24,548	4	0.96
Nebraska	24,790	4	0.88**
Wisconsin	9,364	2	0.93
Indiana	4,464	3	0.93
TOTAL	105,379	14	0.89

Most re-flights due to clouds or crab (very few missed position)

Experienced flyers more efficient avoiding clouds (fewer clouds)

Roughly 2/3 of rejections in 04 were crab

Roughly 1/3 of rejections in 03 were crab

* Excessive re-flights (crab, film scratches in lab)

** Excessive re-flights (film scratches in lab)

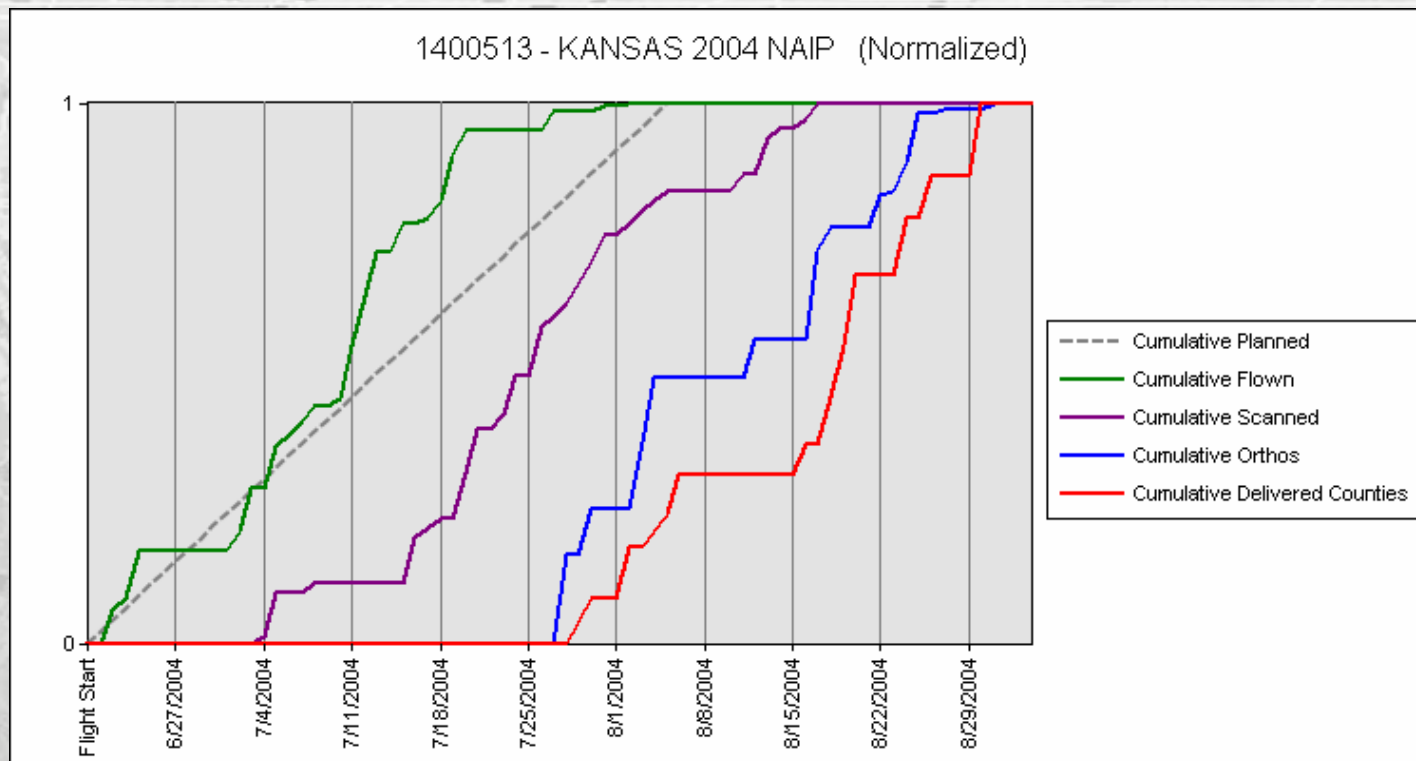


Photography Performance



Project Area	Actual Flight Line Miles (FLM)	Actual Days of Photo	FLM / Day of Photo	Total Season (Days)	FLM / Day of Window
OK West	11,336	18	640	35	324
OK East	9,181	22	417	45	204
Missouri	21,696	27	804	82	265
Kansas	24,548	24	1,023	42	584
Nebraska	24,790	21	1,180	51	486
Wisconsin	9,364	20	468	48	195
Indiana	4,464	10	446	47	95
TOTAL	105,379	69	1,527	92	1,145

Cumulative Graph (Kansas)

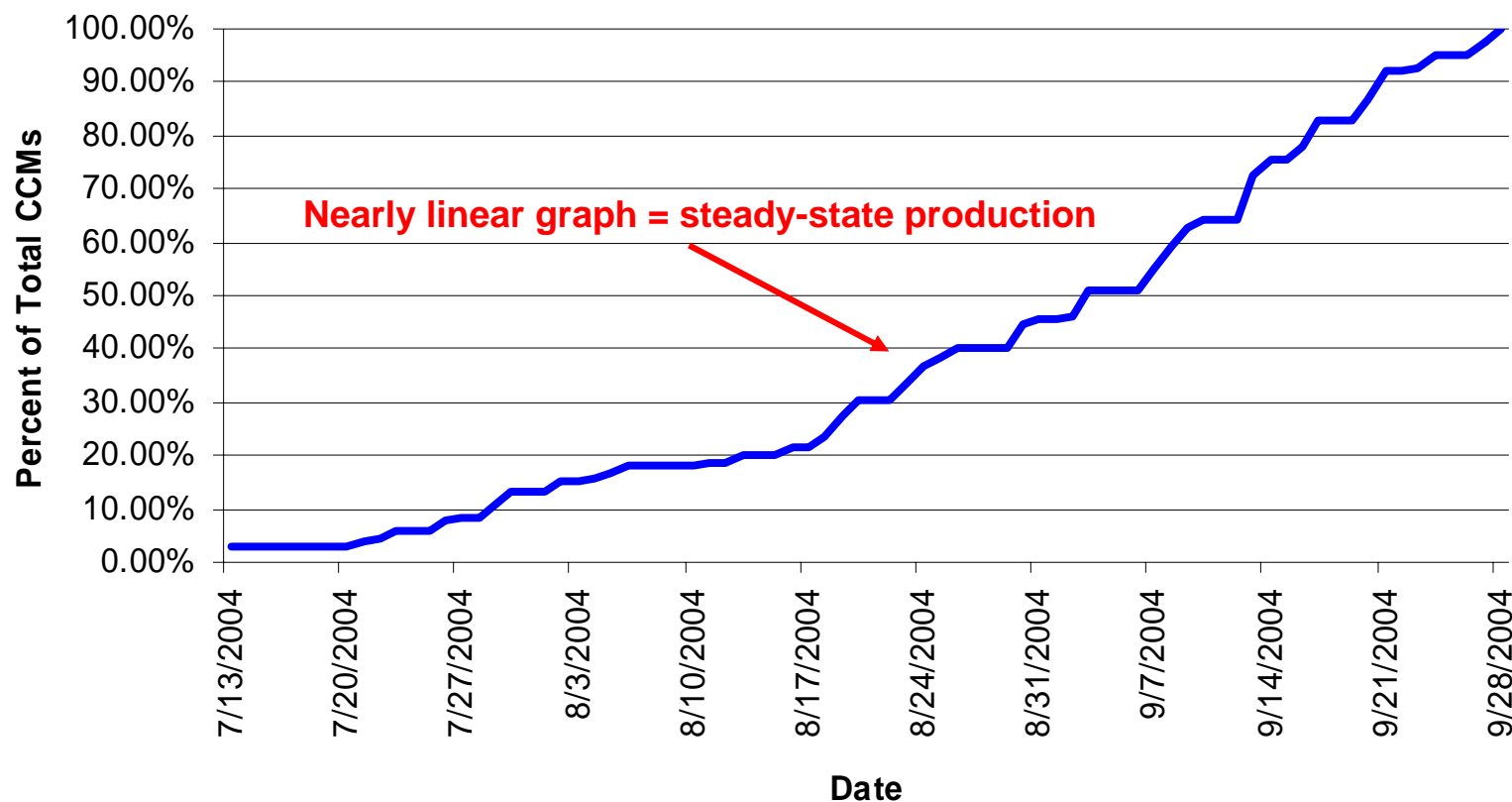


- ~ 10 days from photography through completion scanning (includes ABGPS processing, film inspection/titling, scanning, dodging)
- ~ 7-10 days from scanning through completion of orthos (includes AT and orthorectification)
- ~ 3-7 days from orthos through CCM generation (balancing, MrSID compression, QC, accuracy assessment, shipment)

CCM Delivery



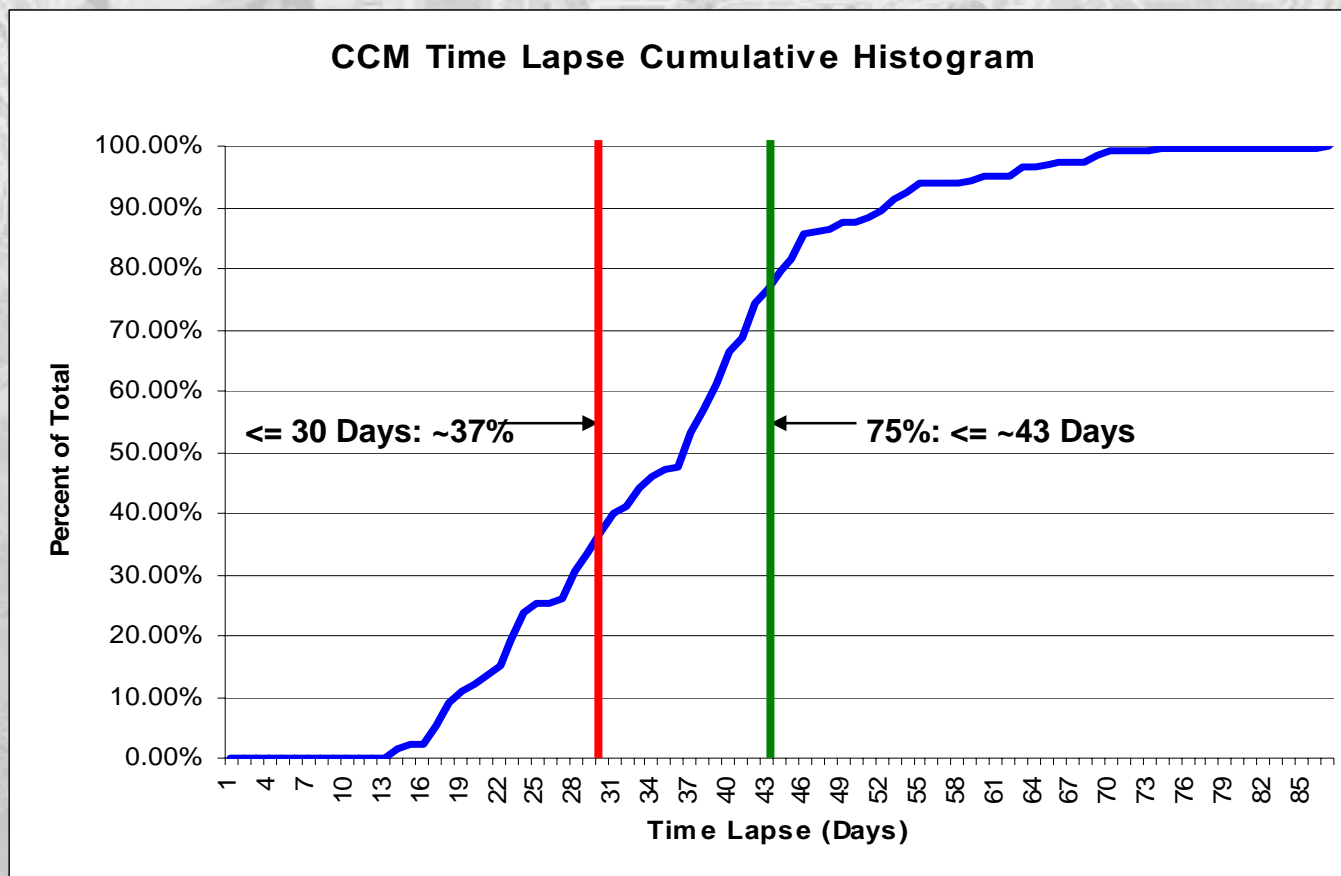
CCM Cumulative Deliveries by Date



CCM Production Time Lapses



- Team goal was to deliver 75% of CCMs within 30 days of last exposure in a CCM
 - 75% level attained at ~43 days
 - Average lapse was ~37 days



Accuracy Assessment



- Not contractually required for 2 meter products – done to support re-sale
- Based on interactive measurement against reference CCMs/DOQQs
- All statistics in meters
- RMSE: combined X,Y RMSEs as per NSSDA specifications
- CE95: RMSE converted to circular error at 95% confidence interval
- Average CE95 of ~4.9 meters (specification was 10 meters)

Project	RMSE	CE95
OK West	2.5	4.4
OK East	2.7	4.7
MO	2.7	4.6
KS	2.6	4.5
NE	3.3	5.7
WI	3.3	5.7
IN	2.7	4.6



Resource Capacity



- Flying was well-resourced:
 - Additional flyer added after award to compensate for loss of teammate (Kucera aircraft accident)
 - 14 planes from a total of 7 companies
 - Experienced flyers (2003 NAIP) performed well
 - Newer flyers were less efficient (clouds, ABGPS collection largest problems)
 - Enhanced database supported more efficient coordination and prioritization
 - Dedicated, full-time flight coordinator within Surdex
- Image scanning was well-resourced:
 - Only high-speed scanners employed (for 1-meter resolution)
 - Consistency: all teammates used same procedures and Surdex-developed software for dodging
- AT, orthorectification, CCM production resources not stressed as in 2003 NAIP
 - Re-investment in increased automation paid off
 - Enhanced database support
 - Extensible



Subcontract Management



- Experienced teammates came through with more efficiency
- As expected, inexperienced flyers were inefficient and somewhat mistake-prone
 - Clouds
 - Crab
 - Some ABPGS collection problems
 - Getting used to high-altitude flight conditions
- Improved flight tracking and coordination yielded more efficiency
 - Enhanced database
 - Dedicated flight coordinator within Surdex
- Some problems with image scanning quality and throughput
 - Some re-scanning by Surdex required
 - More off-season training required
 - New procedures being adopted to reduce reliance on proper scanning and dodge parameters
 - Will tighten turn-around time for film and scans to provide more QC and correction time at Surdex



New Implementations



- Significant re-investment in the enhancement of flight and production databases:
 - Development undertaken before and during project
 - More items and metrics tracked than in 2003 NAIP
 - Better support for teammate status input
 - More queries and reports created in response to production requirements
 - Daily posting of standard status reports
 - Real-time status queries
 - Standard reports available to teammates via web
 - Generally usable for all types of projects

- Benefits
 - Better flight coordination (up-to-date information)
 - Project team and Surdex Executive Team fully informed at all times
 - Caught problems earlier – before they became a real problem
 - Supported remedial actions and investigations
 - Numerous statistics available to evaluate performance and provide insight into NAIP05 process changes

New Implementations



- Hardcopy posted each morning for project team
- Posted to dedicated web-site
- Available real-time within Surdex

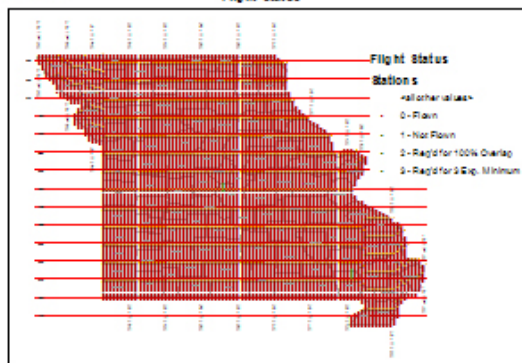


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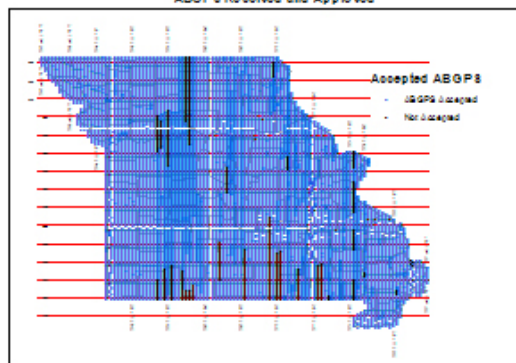
Missouri 1400512 Production Progress

Status as of: 8/18/2004 9:57:50 PM

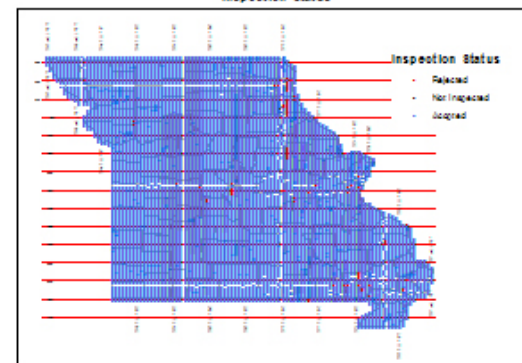
Flight Status



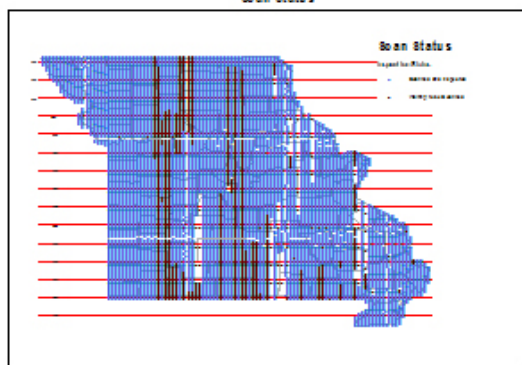
ABGPS Received and Approved



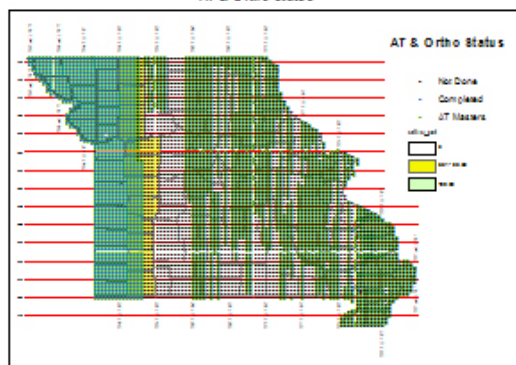
Inspection Status



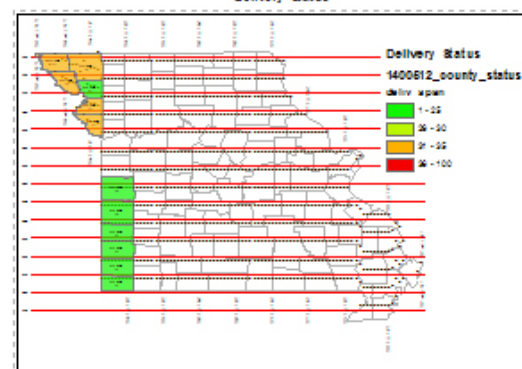
Scan Status



AT & Ortho Status



Delivery Status





New Implementations



- Increased automation:
 - Automatic assessment of accuracy factors during DOQQ production
 - Tracking of performance on various processors
 - Automatic generation of various scripts (such as orthorectification)
 - Automatic population of MrSID project files for each CCM
 - Automatic FGDC-compliant metadata files and shape files
- Benefits
 - Reduced labor – allowed more focus on quality and planning
 - Reduced human errors
 - Leveled resources – as opposed to periodic bursts of effort
 - Increased production throughput
 - Performance tracking supported better projection of time and resources – improved planning
 - Higher throughput



After Contract Re-Sale



- 2003 NAIP – total to date of ~\$124K
 - Small amounts to engineering companies, counties, municipalities through direct sales
 - Counties (26 to date) for Census Bureau contractors (feature extraction)
- 2004 NAIP – total to date of ~\$75K
 - Homeland Security (metro areas at 1' resolution)
 - More Census Bureau as more feature extraction work gets underway?
 - Web-based sales – lower per unit revenue, possibly higher total revenue
- Anticipated revenue: net ~1-3% of NAIP contract value
 - Cost of data preparation (varies) reduces net affect
 - Still too soon to tell – waiting for final approval for commercial resale in spring of '05
 - Must build momentum – resale emphasis by contractors will help
 - 2006 NAIP will realize the benefits



Recommendations



- Consider relaxing film photography specifications:
 - Primarily crab and tilt – softcopy exploitation not affected by these parameters (though analog may be)
 - Base acceptance on suitability of properly generating a full DOQQ?
 - Would ensure quicker acquisition (eliminate some re-flights)
 - Would reduce cost/price to government
 - Would reduce temporal displacements within a CCM that interfere with FSA Compliance activities
- Reduce compression on 2-meter CCMs (from 50:1 to ~20:1?) to enhance user interpretation
- Propose joint industry/government working group to address radiometric balancing specifications and guidelines for NAIP:
 - “Aggressive” balancing to achieve seamless appearance generally reduces quality and detail (primarily due to effects of temporal displacement)
 - What is the right colorimetry for a project area? Do we need color templates?
 - Is a seamless appearance for an entire project area really possible under the summer photography conditions? Balance only within a CCM? Differential balancing within a CCM?
 - Very tough problem to quantify – compile example problems and suggested solutions?



Recommendations



- Examine need for film batch distinctions:
 - Is there really a significant difference between batches any more?
 - Film suppliers can provide QC test results to validate
 - Would reduce coordination of teams and film suppliers
- Examine feasibility of early and/or late acquisition windows in project areas (such as in OK and TX in 2004):
 - Must work for FSA Compliance activity (crop growing seasons)
 - Cannot be too “fine-grained” – could reduce flying efficiency
 - Help ensure success in areas requiring a “short season” by reducing flying resources
 - Could help reduce temporal displacement within CCMs
- Make awards as soon as possible:
 - Allow teams to better prepare and plan
 - May provide teams to explore ways to work together (especially in adjoining project areas)